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LabVIEW Venus Flytrap ANFIS Inverse Control System for Microwave Heating Cavity

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Abstract
Growing interests in nature-inspired computing and bio-inspired optimization techniques have led to powerful tools for solving learning problems and analyzing large datasets. Several methods have been utilized to create superior performance-based optimization algorithms. However, certain applications, like nonlinear real-time, are difficult to explain using accurate mathematical models. Such large-scale combination and highly nonlinear modeling problems are solved by usage of soft computing techniques. So, in this paper, the researchers have tried to incorporate one of the most advanced plant algorithms known as Venus Flytrap Plant algorithm(VFO) along with soft-computing techniques and, to be specific, the ANFIS inverse model-Adaptive Neural Fuzzy Inference System for controlling the real-time temperature of a microwave cavity that heats oil. The MATLAB was integrated successfully with the LabVIEW platform. Wide ranges of input and output variables were experimented with. Problems were encountered due to heating system conditions like reflected power, variations in oil temperature, and oil inlet absorption and cavity temperatures affecting the oil temperature, besides the temperature's effect on viscosity. The LabVIEW design followed and the results figure in the performance of the VFO- Inverse ANFIS controller.

Keywords
Venus Flytrap Algorithm, ANFIS, Microwave, LabVIEW.

I. Introduction

Numerous studies and books have been written on nature-inspired optimization algorithms [1–7] that have proven highly effective in solving a wide variety of optimization problems. These algorithms are typically rooted in swarm intelligence, such as the Darwinian evolution and natural selection of biological systems utilized by genetic algorithms. Various mathematical operators, such as crossover or recombination, mutation, fitness and selection of the fittest, are employed. Additionally, some algorithms are based on insects, including bee colonies, a, firefly, and glowworms, as well as animals such as birds, bats, monkeys, lions, and wolves. Each of these algorithms boasts unique advantages and perspectives on how to best solve optimization problems, including neural networks, genetic algorithms, particle swarm optimization, bacterial foraging algorithm, shuffled frog leaping algorithm, flower pollination algorithm, and artificial plant optimization algorithm.

One of the latest meta-heuristic algorithms is the Venus Flytrap Optimization (VFO) algorithm, which takes inspiration from the survival strategies of plants in nature. This algorithm is based on the rapid closure behavior of the Venus Flytrap's leaves, which possess two heart-shaped lobes complete with hairs on their surface. The Venus Flytrap has three states of movement [8]: fully open, semiclosed, and fully closed. These states are illustrated in Fig. 1(a). The trap operates by going through three phases: trigger, tightening, and re-opening. Once the prey is inside the trap, it causes the tightening of the trap. However, if there is no movement inside the trap, then the prey escapes and there is no sealing phase. Additionally,